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EXAMINER	
DHINGRA, RAKESH KUMAR	

ART UNIT	PAPER NUMBER
1792	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	**Application No.**	**Applicant(s)**	
	10/501,351	SAMUKAWA ET AL.	
	Examiner	**Art Unit**	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _03_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _06 May 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1,2 and 5-13_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1,2 and 5-13_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _26 December 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1-2, 5-13 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claim 1 by adding new limitations "which comprises an SiO2 layer" and "and a plurality of pores of predetermined size formed through both said pattern layer and said plurality of electrodes". Further applicant has also amended claim 13 for a clerical correction.

Accordingly claims 1, 2, 5-13 are now pending and active.

New reference by Kojima et al (US 6,423,242) when combined with Ma, Smesny and Loewenhardt teach all limitations of the claim including the newly added limitation that pattern portion comprises SiO2, and plurality of pores formed through both pattern portion and the plurality of electrodes. Accordingly claims 1, 5, 6, 9 and 12 have been rejected under 35 USC 103 (a) as explained below. Balance claims 2, 7, 8, 10, 11 and new claim 13 have also been rejected under 35 USC 103 (a) as explained below.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary.

Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1, 5, 6, 9 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al (US 6,576,922) in view of Smesny et al (US 5,444,637), Loewenhardt et al (US 5,451,784) and Kojima et al (US 6,423,242).

Regarding Claim 1: Ma et al teach an apparatus (Figures 2, 6, 9-13) comprising:

an on-wafer plasma monitoring apparatus 112 (Figure 2) comprising:

a ferroelectric (FE) capacitor 110 with antenna 114 (one or a plurality of sensor sections) provided on a substrate 118 and includes a pattern portion comprising of SiO2, which is a plasma treatment target, and a plurality of electrodes 126, 122 with insulating film 124 between the electrodes, and where the uppermost electrode 126 has same potential as that of substrate 18 (through resistor 142, upper and lower vertical conductive portions 127, 128 and antenna 114 respectively). Ma et al also teach a sensor 116 formed at the bottom of the sensor section 110 and connected to probe pad 144 that can be formed through a patterned portion (e.g. Figs. 2, 6, 9-13 and col. 6, line 36 to col. 7, line 58).

Ma et al teach on-wafer sensors but do not explicitly teach a plurality of pores of predetermined size formed through both said pattern portion and said plurality of electrodes, and also do not teach a power source unit and an I/O unit that inputs/outputs signals from to/outside and where the power source unit takes out power from plasma potential or takes out power from photo-electromotive force of a PLZT device.

Smesny et al teach a plasma sensing apparatus (Figures 1, 2) comprising:

A wafer 10 with plurality of sensors 12, a power source 16 that can use plasma photon energy and coverts it to electrical energy, a signal acquisition and conditioning unit 18 with processor 20 (like an I/O

unit) that receives/sends signals from outside (through external control circuit 22) [column 6, line 35 to column 7, line 50].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the plasma monitoring system with power source unit and I/O unit as taught by Smesny et al in the apparatus of Ma et al to enable operation of various sensors/other circuits on the wafer.

Ma et al in view of Smesny et al do not teach plurality of pores of predetermined size formed through both said pattern portion and said plurality of electrodes.

However providing opening (pores) in the electrodes that are used for monitoring ion energy is known in the art as per reference cited hereunder.

Loewenhardt et al teach an apparatus for ion energy measurement during semiconductor wafer processing (Figs. 1, 2, 4, 5) comprising:

a monitoring wafer 102 with ion energy analyzers 104, and pattern portion having layers of insulation 202, 208, 214 with apertures, plurality of electrodes 206, 212, 218 having pores of predetermined size (approx. 200 mils per inch) and where the measuring system enables to measure ion current and to obtain ion energy distribution (e.g. Figs. 1, 2, 4, 5 and col. 3, line 30 to col. 6, line 15).

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide a measuring system with a pattern portion of sensor sections and pores in the electrodes as taught by Loewenhardt et al in the apparatus of Ma et al in view of Smesny et al to obtain accurate ion energy profile.

Ma et al in view of Smesny et al and Loewenhardt et al do not explicitly teach that the plurality of pores of predetermined size are formed in the pattern portion that comprises SiO_2.

However it is known in the art to use SiO_2 layer as a pattern portion over a wafer in semiconductor processing to obtain precise etching of holes with higher aspect ratio and obtain precise monitoring of plasma parameters.

Kojima et al teach a method of plasma etching comprising a substrate 61 with an oxide layer 65 that is patterned to form a hole portion "A" in the oxide layer. Kojima et al further teach that use of etched SiO2 enables to achieve higher selectivity. It would be obvious to use silicon oxide layer that is patterned and enables to provide holes (pores) with higher aspect ratio as taught by Kojima et al in the apparatus of Ma et al in view of Smesny et al and Loewenhardt et al to achieve etching with higher selectivity and obtain precise monitoring of the plasma process.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide silicon oxide layer that is patterned and enables to provide holes (pores) with higher aspect ratio as taught by Kojima et al in the apparatus of Ma et al in view of Smesny et al and Loewenhardt et al to achieve etching with higher selectivity and obtain precise monitoring of the plasma process.

Regarding Claims 5, 9: Smesny et al teach that the test wafer includes an input probe that can receive optically transmitted information (would include photon detector) [column 5, lines 1-22].

Regarding Claim 6: Loewenhardt et al teach that the apparatus (Figures 1, 2) includes a monitoring wafer 102 with ion energy analyzers 104 and where a collector electrode 200 is disposed at the bottom of the sensor section that measures ion current and enables to obtain ion energy distribution (column 3, line 30 to column 6, line 15).

Regarding Claim 12: Loewenhardt et al teach probes 106 that can measure ion current (Figure 2 and column 6, lines 1-15).

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al (US 6,576,922) in view of Smesny et al (US 5,444,637), Loewenhardt et al (US 5,451,784) and Kojima et al (US 6,423,242) as applied to claims 1, 5, 6, 9, 12 and further in view of Ma (US 6,673,636).

Regarding Claim 2: Ma et al ('922) in view of Smesny et al, Loewenhardt et al and Kojima et al teach all limitations of the claim including plurality of electrode separated by insulation layers, but do not

teach that plurality of electrodes of sensor section are aluminum electrodes and space between each of aluminum electrodes is insulated by gamma-Al_2O_3.

Ma ('636) teach an apparatus (Figures 5-7) for real time measurement of plasma parameters and comprising of a silicon substrate 601 provided with an aluminum electrode 604 in a patterned portion of a resist layer and where there is an insulator layer 603 of Aluminum oxide (Al_2O_3) provided between substrate and the electrode 604. Further, it is known in the art to use anodization, that is, aluminum oxide (gamma-Al_2O_3) as insulating layer over silicon wafers (column 3, line 1 to column 4, line 20 and column 5, line 1 to column 6, line 65).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use aluminum as electrode material and aluminum oxide as insulator material as taught by Ma et al ('636) in the apparatus of Ma et al ('922) in view of Smesny et al, Loewenhardt et al and Kojima et al due to aluminum being a known good conductor suitable for plasma processing environment and aluminum oxide having better anti-corrosion properties than other comparable materials like SiO_2.

Claims 7, 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al (US 6,576,922) in view of Smesny et al (US 5,444,637), Loewenhardt et al (US 5,451,784) and Kojima et al (US 6,423,242) as applied to claims 1, 5, 6, 9, 12 and further in view of Toyoda (US 6,462,328).

Regarding Claim 7: Ma et al in view of Smesny et al, Loewenhardt et al and Kojima et al teach all limitations of the claim including use of photon detectors as sensors, but do not teach photo detector detects light made incident into a pattern by photo-induced current generated in an insulating film.

Toyoda teaches an apparatus (Figure 5) that includes photosensors Dr, Dc that detect light after passing through silicon oxide (insulating film) 40, 38, 25 and where the electric current is proportional to the amount of incident light (column 5, lines 38-58).

It would have been obvious to one of ordinary skill in the art at the time of the invention to manufacture photo-detection sensor as taught by Toyoda in the apparatus of Ma et al in view of Smesny et al, Loewenhardt et al and Kojima et al to obtain accurate an accurate measurement of light energy.

Regarding Claim 8: Toyoda teaches that photo sensor includes an aluminum film (metal film) 42a formed on the oxide film 40 that helps to avoid scattering light reaching the light receiving sensor portions. Further, the dependence of light detected on the work function difference is a functional aspect that would depend upon the type of materials selected for the metallic and the oxide coatings and other related parameters.

Claims 10, 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al (US 6,576,922) in view of Smesny et al (US 5,444,637), Loewenhardt et al (US 5,451,784) and Kojima et al (US 6,423,242) as applied to claims 1, 5, 6, 9, 12 and further in view of Pinnaduwage (US 5,896,196)

Regarding Claims 10,11: Ma et al in view of Smesny et al, Loewenhardt et al and Kojima et al teach all limitations of the claim including use of spectrophotometer sensors, that incorporate specific bandwidth optical filters using chip fabrication techniques for measuring plasma parameters like ion current flux, charge particle (like ions) density etc.

Ma et al in view of Smesny et al, Loewenhardt et al and Kojima et al do not explicitly teach use of spectrophotometric sensors for identification of radicals and ions by collision between ions/radicals and electrons generated by an electron gun.

Pinnaduwage teaches an apparatus (Figures 1-3) where a glow discharge apparatus 10 has an analysis region 22 in which an electron beam is introduced from electrode 14 (electron gun) and positive and negative ions can be identified using optical spectrometer 54. Pinnaduwage also teaches that typically in prior art an electron gun is used as a source of electrons that collide with gas particles (column 1, line 10 to column 32, line 30).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use ion radical identification techniques as taught by Pinnaduwage in the apparatus of Ma et al in view of Smesny et al, Loewenhardt et al and Kojima et al to enable accurately identify ions and radicals using emission spectro-photometric techniques.

Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ma et al (US 6,576,922) in view of Smesny et al (US 5,444,637), Loewenhardt et al (US 5,451,784), Kojima et al (US 6,423,242) and Ma (US 6,673,636) as applied to claim 2 and further in view of Johnson et al (US 2004/0021094).

Regarding Claim 13: Ma et al ('922) in view of Smesny et al, Loewenhardt et al, Kojima et al and Ma ('636) teach all limitations of the claim except that side surface of aluminum electrode is covered with a thin oxide film.

Johnson et al teach an apparatus (Figures 2-5) that includes a monitoring wafer 12 with a substrate 20 that has aluminum ion current collectors (electrodes) 26 that have an anodized (covered with thin oxide film) cylindrical surface (e.g. Figs. 2-5 and para. 0039, 0040).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use aluminum electrodes with side surface covered with oxide film as taught by Johnson et al in the apparatus of Ma et al ('922) in view of Smesny et al, Loewenhardt et al, Kojima et al and Ma et al ('636) to insulate the electrode from the adjoining structures (like wall of enclosing wafer 10 or adjoining electrodes).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/

Examiner, Art Unit 1792

/K. M./
Primary Examiner, Art Unit 1792